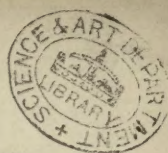


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COMMITTEE OF COUNCIL ON EDUCATION,

Science and Art Department.

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GENERAL DESCRIPTIVE NOTICE

OF THE

MUSEUM OF IRISH INDUSTRY

AND

GOVERNMENT SCHOOL OF SCIENCE APPLIED
TO MINING AND THE ARTS,

51, STEPHEN'S-GREEN, DUBLIN,

Indicating the Objects, Nature, and Classification of the Technological and
Geological Collections, and the Arrangements for Industrial Education
in the Scientific Departments of the Museum, for the Session
1861-62, together with a Lithographed Plan of the
Museum, Galleries, and Offices.

THE SESSION WILL BE OPENED ON THE 3RD OCTOBER, BY AN ADDRESS
FROM THE DIRECTOR, SIR ROBERT KANE.

DUBLIN:

PRINTED BY ALEX. THOM & SONS, 87, ABBEY-STREET,

FOR HER MAJESTY'S STATIONERY OFFICE.

1861.

COMMITTEE OF THE BOARD OF EDUCATION

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INTRODUCTORY NOTICE

OF THE

ORIGIN AND GENERAL OBJECTS OF THE MUSEUM.

IN the year 1845 it was decided by Her Majesty's Government* to establish in Dublin an institution somewhat on the plan of the Museum of Practical Geology in London, but more extended in its objects, as embracing the general range of the industrial arts; and the new institution was placed under the department of the Right Honourable the Chief Commissioner of Woods and Forests.† The house No. 51, Stephen's-green, Dublin, having been soon after purchased for the buildings of the new Museum, and Sir Robert Kane having been appointed Director, some of the collections which were intended to form part of the Museum, were deposited in the building, and were made, as far as possible, available for scientific purposes, and for public inspection. The original building having been, however, only that of a private house, it was necessary to provide a series of proper museum galleries, a lecture theatre, chemical laboratories, &c., before the exhibitional and other departments of the institution could take their final form, or manifest their proper efficiency. The erection of the new galleries and other buildings was accordingly commenced in 1847; but, owing to the execution of these works being spread over a period of more than four years, it was not until 1852 that the buildings attained the state of completion which admitted of the definitive arrangement and classification of the several collections being taken in hands. Ever since that time, however, the work of organization, and the acquisition of new materials for the collections, has steadily progressed; and, in addition to the more purely exhibitional department, to which the galleries are devoted, there have been established also, as portions of the institution, the Government School of Science applied to Mining and the Arts, and a special chemical department, with laboratories, for carrying on such scientific researches as might be required for the public service, and also for giving instruction in practical and analytical chemistry. These several departments will be more fully noticed further on.

* The late Sir Robert Peel, Bart., being Prime Minister.

† The Duke of Newcastle, then Earl of Lincoln, being Chief Commissioner.

When the Museum was first established, it was contemplated with especial reference to the reception of the collections of specimens which should be formed during the progress of the Geological Survey of Ireland, then about to be recommenced as a part of the Geological Survey of the British Islands, under the direction of the late Sir Henry Delabèche; and in analogy with the title of the somewhat similar institution in London, previously established, it was termed the Museum of Economic Geology. But the utility and importance of the more general industrial objects of the Museum becoming better understood, and those portions of the Museum acquiring rapidly a greater development, to which a powerful stimulus was afforded by the example of the great Exhibition in London in 1851, and of that similar great Exhibition held in Dublin, in 1853, it was decided by the Right Honourable the Earl of Carlisle, when Chief Commissioner of Works, that the name of the institution should be altered to that of the Museum of Irish Industry, which has accordingly been the designation since employed.

In March, 1853, the Museum of Irish Industry was transferred from the department of Works, under which it had been since its foundation, to the Department of Science and Art, then newly created as a branch of the Board of Trade. In the year 1857, the Department of Science and Art was transferred from the Board of Trade to the Committee of Privy Council for Education Science and Art Department, and the Museum of Irish Industry has consequently remained since then under the supreme direction of that branch of the government. The staff of the Museum consists of the following officers at present:—

Director—Sir Robert Kane, F.R.S., M.R.I.A.

Professors.

Geology—J. Beete Jukes, M.A., F.R.S., F.G.S., M.R.I.A.

Physics—William Barker, M.D., M.R.I.A.

Chemistry—William K. Sullivan, Ph.D., M.R.I.A.

Practical Chemistry—Robert Galloway, F.C.S.L.

Botany—William H. Harvey, M.D., F.L.S., M.R.I.A.

Zoology—John R. Kinahan, M.D., M.R.I.A.

Chemist—Robert Galloway, F.C.S.L.

Curator—Alphonse Gages.

Assistant Chemist—William Plunket.

Clerk and Accountant—George Penny.

By the title of Museum of Irish Industry it is not intended to imply that the collections or objects of the institution are

exclusively industrial, or exclusively Irish. The great object for which the Museum was founded, however, being the representation of the physical structure and capabilities of Ireland, and the diffusion of sound scientific instruction as to the means by which the resources of the country could be most usefully applied, and the popular mind directed to subjects of permanent utility, and practical value, the collections of strictly Irish specimens of geological or industrial interest naturally form the nucleus around which there is grouped and arranged all that can illustrate either the deficiencies or the riches of this country; all that can explain the uses to which its raw materials can be applied; the processes they pass through; and, generally, the various series of specimens by which the condition and progress of the industrial arts, both at home and abroad, can be satisfactorily illustrated by the professor, and comprehended by the student.

The exhibitional departments of the Museum may be considered, therefore, as falling under two principal heads:—first, the specially geological collections; and second, the specially industrial collections. The annexed plans of the Museum galleries will enable the distribution of those several collections to be at once understood.

The geological collections, as displayed in the galleries, consist principally of those formed by the officers of the Geological Survey of the United Kingdom, especially in Ireland; but also with such typical collections from the British Survey, and from Continental sources, as shall render the entire a satisfactory representation of the geological structure and resources, not merely of Ireland, but of the United Kingdom, and of Europe generally. Those collections, of which but a portion has been, as yet, arranged for exhibition, are placed in the special charge of the officers of the Geological Survey while in process of formation, and while the Geological Survey is in progress. Some further explanations of the condition and arrangements of those collections will be found in the notice supplied by Mr. J. Beete Jukes, the Local Director of the Geological Survey of Ireland, and Professor of Geology in the Museum of Irish Industry, which will be found further on.

From the lithographed plan of the Museum annexed, the general nature of its arrangement can be easily understood. The galleries of the Museum being built in two stories, a primary classification is made—into objects of inorganic nature, which are arranged in the lower galleries; and objects of organic nature, which are arranged in the upper galleries. In one instance this principle of classification is not strictly observed. The collection of specimens of fossil fuel, (peats,

lignites, and coals, with their products and applications,) although properly belonging to those of organic nature, are yet placed in the lower north gallery. For this there are two reasons:—first, that the most important fossil fuels are so closely connected with metallurgical operations, especially that of iron, with the principal ores of which metal also the coal deposits possess important geological relations, that the industrial history of the metals and of the fuels could scarcely be separated without practical inconvenience; and second, that, although of organic origin, the fossil fuels represent so characteristically the transition from organic to mineral nature, that they may very suitably be taken, as they actually are taken in the Museum, as forming the connecting link between the true mineral substances and the vegetable tissues (woods and fibres) with which the collections in the corresponding upper gallery commence.

On each floor of the Museum are three galleries, which are distinguished respectively, as the cross gallery and the north and south galleries. The main entrance to the Museum from Stephen's-green opens through the marble-hall into the centre of the lower cross gallery. From this the north and south lower galleries pass, and terminate at their east ends in staircases, by which the upper and lower series of galleries are connected. The general plan of arrangement may be simply described, but it must be borne in mind that the entire system of classification and arrangement of the special collections is still in progress, and consequently liable to frequent alteration, according as new acquisitions are made, or as specimens are replaced by others better adapted for scientific or industrial instruction.

The entrance hall of the Museum is employed for illustrating the applications of Irish marbles to the purposes of decorative architecture.

The lower cross gallery is devoted to collections illustrative of materials used in the arts of construction, such as the building stones of Ireland and England, flags, slates, cements, marbles, porphyries, serpentines, &c. Some materials of this class, of too massive a character for this gallery, will be found near the staircase at the end of the lower south gallery.

The lower south gallery is occupied partly with geological and partly with metallurgical and mineralogical collections. The geological collections are those intended to illustrate the lithological characters, and the history of the nonfossiliferous rocks. The metallurgical collections represent the geological position and nature of the ores, the metallurgic treatment, the uses, and derived compounds of copper, lead, zinc, tin, antimony, silver, and gold; the processes and results

of electrotyping, and the applications otherwise of those metals to industrial uses.

The mineralogical collection, which has been formed principally with a view to the practical uses of minerals, is in process of arrangement, according to the classification of Dufresnoy.

At the end of the lower south gallery are placed some very massive specimens, one being a mass of the rock-salt obtained from the new salt mines opened near Belfast, by the Marquess of Downshire, and those at each side of it being blocks representing the two thickest beds of coal in the Kilkenny (Leinster) coal field, viz., the three-foot seam and the four foot seam.

The lower north gallery is devoted to the illustration of the history of the iron manufacture, of fuels, of the mineral-chemical manufactures, and of the manufacture of pottery and glass.

The Irish fuels and their products are shown from the most recent peat to the mineralized stone-coal, or anthracite, of which the principal coal fields in Ireland consist. The iron-stones of the several Irish coal fields are given; and in connexion with the Connaught coal field the ores which occur at Arigna, on Lough Allen, in Leitrim, and specimens of the iron manufactured at that place are shown. Among the products obtained from fuels, the oils and solid fats (paraffine) employed for making candles, as substitute for wax or spermaceti, will be found.

In connexion with the history of the iron manufacture in Great Britain, illustrations of the coals and clay iron-stones of the several coal fields of Great Britain are given, and of the varieties of oxides (hematites) and carbonates of iron employed as ores for iron-smelting. Series of specimens of the manufactured iron, as pig, bar, and sheet, illustrating the manufacture as carried on in the most important localities, as Lanarkshire (Monklands), Shropshire (Colebrookdale), Staffordshire (Wolverhampton), and Yorkshire (Lowmoor), will be found arranged in connexion with the coals and ores.

Illustrations of the manufacture of various classes of objects of iron and steel, from railway axles to needles, are exhibited.

The mineral-chemical manufactures, illustrated, are principally those founded upon or derived from the employment of the iron pyrites (or sulphuret of iron) as a source of sulphuric acid; this mineral being found and worked in great abundance in the Ovoca district of the county Wicklow, and affording extensive employment. The manufactures of sulphur and sulphuric acid, of sulphate of soda, and carbonate of soda, of sulphate and carbonate of magnesia, sulphate of

iron, and alum, and other derivative chemical products, are illustrated.

A collection of specimens belonging to this class, illustrating the sources and properties of the earth alumina and the metal aluminum, together with the manufacture of artificial ultramarine and the alumina lakes, are at present deposited in the lower cross gallery until the arrangements for the department of chemical manufactures are more fully carried out.

In the lower north gallery is contained the collections illustrating the manufacture of pottery, porcelain, and glass. These collections may be considered as embracing three divisions, viz.:—first, a historical series showing the varieties of the manufacture from the earliest times; second, a series illustrating the diversity of manufacture and decoration in various countries; and, third, a series illustrating the chemical and mechanical materials, processes, and instruments employed in the manufacture, especially as carried on in England. Specimens of the pottery manufactured in Ireland, and of the clays, &c., employed, are also given.

A small, but very instructive, series of enamels serves to illustrate the various styles and materials employed in that interesting art; and there are specimens of Byzantine and Limoges enamels, and modern applications of enamelling, both Chinese and European.

The application of stained and painted glass to decorative purposes is shown by the beautiful window presented by Mr. John Gibson, of Newcastle, and placed at the end of the north galleries, and also by that constructed by Messrs. O'Connor, formerly of Dublin, now of Berner's-street, London, placed in the lower cross gallery, opposite the entrance from the hall.

The upper north gallery is devoted to collections illustrating the industrial applications of vegetable and animal substances. The series begins with the woods, then passes to fibres, in which the flax fibre, which is the basis of the great linen manufacture of Ireland, occupies a prominent place. The flax fibre is traced, and its uses shown from the stage of the growing flax plant, the flax prepared for spinning, the yarn, the linen cloth of various qualities and classes; the rags and the paper made from them, and the papier mache prepared from refuse paper, which when varnished, gilt, and inlaid with pearl and painted with flowers, forms so ornamental a branch of manufacture.

The history of cotton is similarly treated, and a similar exposition of the silk manufacture is in progress, but is at present limited to the illustration of that branch of the silk manufacture which is extensively carried on in Dublin, viz.,

that of poplin or tabinet. The sources, modes of manufacture and applications of caoutchouc and gutta percha, are also very fully illustrated.

The series of woollen manufactures is in progress of formation, but has not yet been nearly completed. The collections of the different varieties of wool and hair, and their applications, are, however, already extensive. The industrial applications of animal substances are further illustrated by the preparation of feathers, horn, bones, &c.

A case is devoted to the history of the varieties of starch and sugar, of fatty bodies, animal and vegetable, and of their uses. The collections of materials and products of the manufacture of leather and of dyeing materials, are but partially arranged as yet.

The upper south gallery is devoted exclusively to the palæontological collections of the Geological Survey—the explanations regarding which will be found further on.

The upper cross gallery contains a collection, which is but now in process of formation, of models of the different kinds of boats, nets, and other equipments employed in the fisheries on the coast of Ireland. In connexion with it will be arranged illustrations of the fish usually caught in the Irish seas, the baits, &c., employed in the fishery.

This gallery contains, at present, a collection of birds, of fishes, shells, and other objects of natural history, of which only a portion, not yet separated, has any immediate industrial relations. This collection, together with a collection of the rocks and minerals of the north of Ireland, was formed during the progress of the Geological Survey of Ireland, under the direction of Colonel Portlock, R.E., when that Survey was carried on as a part of the General Topographical Ordnance Survey, and was made to embrace the General Natural History of the country. The mineralogical and geological specimens have found their place with the other collections, since formed by the Geological Survey, and in the Museum: but the zoological and botanical collections are preserved so far separate, as the period for the final arrangement had not yet arrived.

For the more perfect illustration of the mechanical and chemical processes employed in the industrial arts, an extensive series of models of machinery, furnaces, and other constructions, on a correct scale, is in preparation. Those which have been as yet finished, and are deposited in the galleries, will serve to indicate the manner in which it is intended to carry out this department in its several branches. Thus—

1. *Of Mining Machinery and Constructions.*—A working sectional model of a mine shaft, showing the mode of tim-

bering; the winch or horse-gin, for elevating the ores; and the ladders and machine-lift, by which the workmen ascend and descend.

2. *Of Iron and Steel Manufactures.*—Models of the high furnaces for iron smelting, and of furnaces for the manufacture of cast and of bar steel.

3. *Of Pottery and Earthenware Manufacture.*—Models of the furnaces or kilns employed in the potteries in Staffordshire, for baking and firing the ware, and of the glazing or enamelling furnace.

4. *Of Chemical Manufactures derived from Sulphur and Common Salt.*—Models of leaden chambers and kilns for making sulphuric acid. Salt cake (sulphate of soda) furnaces, and chloride of lime stills and condensers, as at present used in the best constructed factories.

5. *Models*, with sections of the improved furnaces employed for the smelting of lead ores at the works of the Mining Company of Ireland, Ballycorus, County Dublin.

A series of models of the lathes and tools employed in the shaping, working, and modelling the several kinds of pottery.

In the upper south gallery are deposited a series of models of looms and machines, being the commencement of the series to illustrate the processes of the textile manufactures. The models, as yet completed, belong to some forms of silk and worsted manufacture, which are carried on in Dublin, as velvet, poplin, or tabinet, carriage lace, girths, &c. In connexion with them, a series of illustrations of the preparation of silk from the cocoon, and of the natural history of the silkworm, has been arranged for exhibition.

Connecting the eastern extremities of the north and south ranges of galleries, and closing the quadrangle of the building, is the lecture theatre, in which the Professors of the Museum deliver their courses of instruction. The subjects on which lectures are delivered, are Geology (including Physical Geography), Natural Philosophy, Theoretical Chemistry, Practical Chemistry, Zoology, and Botany. Of the courses of lectures delivered some are of a more elementary character, and are open to the public. Others belong to a regularly framed curriculum of studies, followed by students who are registered on entrance, and are submitted to examinations at the end of the course, when prizes are awarded for superior merit. This systematic course of industrial education, which constitutes the object of the Government School of Science applied to Mining and the Arts, is carried out with the co-operation of the Royal Dublin Society, which allows of several of the courses of lectures being delivered in the

lecture theatre of that institution, and supplies from the Botanic Garden, and other collections, assistance towards the illustrations of the lectures.

A special programme of those educational arrangements is published, and may be had on application at the Museum of Irish Industry.

The Museum possesses a select library of scientific reference for the use of the Officers and Professors, to which the students of the Government School of Science are admitted, under certain regulations.

In the offices of the Museum is deposited a series of maps connected with Ireland, including those of the Ordnance Survey; a series of coloured maps, showing the distribution of the values of land in the Irish counties, according to the official valuation; and a series of agronomical maps, showing the nature and distribution of the agricultural soils in some of the Irish counties in which the materials for that investigation were obtained.

The Chemical Department of the Museum consists of two ranges of laboratories: one in immediate connexion with the Museum galleries, which is devoted to the more delicate operations of research, and to analytical instruction; and the other, in the basement story, appropriated to the metallurgic, and other furnace operations, and preparation of materials, reagents, &c. A portion of this laboratory is also fitted up for the practical instruction of pupils. By means of this department, chemical analysis of rocks and minerals, ores, soils, &c., when required for the purposes of the Museum, or for other objects of scientific inquiry, or for the purposes of the public service, are carried on; and reports are made to the heads of the department under which the Museum is placed, or to the other departments of government from which scientific references for information are made. The chemical examination of the various materials and products belonging to the industrial arts, exhibited in the galleries, and inquiries suggested by their circumstances and properties, forms, naturally, a main portion of the duty of this important branch of the institution. This chemical department is specially under the charge of Mr. Robert Galloway, Chemist to the Museum.

For the purpose of affording explanation as to the nature, history, and uses of individual specimens in the Museum collections, it is preferred to attach to the objects, labels, affording the necessary details, and thereby to avoid the necessity of reference to the pages of an extensive and complicated catalogue; the more so, as from the continual changes which occur among the specimens of a museum

in process of organization, any catalogue in detail must become, to a certain extent, inapplicable after a short time. A system of very full and explanatory labelling of the specimens has therefore, been carried out by the Curator of the Museum, Mr. Alphonse Gages; but in order to afford, as far as possible, further and more extensive information as to the classes of objects in the Museum than could be given upon the labels, the several officers of the institution, connected with the departments of science to which the collections respectively belong, have prepared general descriptions of those collections, and a detailed catalogue, or inventory of the contents of the Museum is also in preparation. An explanation of the arrangements of the Geological collections, drawn up by Mr. Jukes, Local Director of the Geological Survey and Professor of Geology, is annexed to this introductory notice.

It will, however, be understood, that those general descriptions do not in any way pretend to the character of a full or detailed catalogue of the objects contained in the Museum, or of a complete explanation of the history or properties of such as are individually referred to. On the present occasion it is only sought to supply such a popular guide to the collections as, in conjunction with the system of descriptive labels, may enable any ordinary visitor to understand the objects and the uses of the Institution, and to become acquainted with the nature of its contents. By such means it is believed that a great deal of valuable instruction in the industrial sciences may be conveyed, and the advantages of further systematic study made evident; those descriptions will be, of course, rendered more and more complete, according as the organization of the Museum progresses.

For the purpose of estimating approximately the amount of time which may be required for the complete numbering, labelling, and cataloguing the collections of the Museum, the Curator, Mr. Gages, has made the following estimate of the numbers of individual specimens in the several principal divisions:—

In Lower Cross Gallery, . . .	2,198
In Upper ditto, . . .	890
In Lower North Gallery, . . .	4,220
In Upper ditto, . . .	3,519
In Lower South Gallery, . . .	3,890

Total in the Technological Por- tions of the Museum, }	14,717
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To this there are to be now added the Trade Collections of Mr. Simmonds, recently purchased, about 4,000 specimens, making the total number of specimens in the Industrial Collections to be 18,717, exclusive of the Palæontological Collections of the Geological Survey, about 7,500 specimens in the Upper South Gallery, and the several collections of rocks, viz., the Portlock Collection, about 1,000; the Krantz Collection, about 666; and that collected by the officers of the Geological Survey, about 750 specimens; making a total of specimens in the Geological departments of about 9,916 specimens, and in the Museum altogether about 24,633 specimens. There are also special collections of specimens and apparatus formed by the Professors and in their personal charge, for illustrating their courses of lectures.

The Museum galleries were open on all week days from 11 till 4 o'clock, during which time there visited the collections, from 1st January to 31st December, 1860, 24,065 persons, being an increase of 509 on the similar number for the preceding year.

The galleries were also open to the public on the evenings when lectures were delivered from 7 till half-past 9 o'clock, and during the winter months in addition on Mondays and Thursdays within the same hours. The total number of visitors in the evenings for the year 1860 was 8,934, making the total number of visitors in the year 32,999.

R. K.

THE PALÆONTOLOGICAL GALLERY.

The collections of fossils in this gallery consist of—

1st. A selection of specimens from the collection made by the Geological Survey of Ireland.

2nd. A set of duplicates from the English collection, sent over from the Museum in Jermyn-street.

3rd. A duplicate set of fossils from the north of Ireland, collected by the Ordnance Survey, under the direction of Colonel Portlock.

The following is the general plan on which these collections are arranged :—

Commencing with the north-west corner of the gallery, the fossils of the lower formation are placed there, and the ascending order proceeds along the north side, round by the east end, and terminates with the highest and newest formations at the south-west corner of the gallery. The northern half of the gallery is devoted to the Irish Palæozoic formations. The southern half of the gallery contains the British Palæozoic, Secondary and Tertiary collection, and the Irish Permian, Lias, Cretaceous, and Tertiary collections.

Commencing at the north-western corner of the gallery, the first small table case and small wall case contain Cambrian fossils, *Oldhamia* from Carrick, Bray, and Howth; tracks and burrows of annelids from Bray (the latter collected and presented by Dr. Kinahan.) The second and third table cases contain Lower Silurian fossils; those from the counties of Meath, Tipperary, Kerry, and part of those from Dublin on the south side, those from the Chair of Kildare and the other part of those from Dublin on the north side. In the wall case are Colonel Portlock's collection of Lower Silurian fossils, from Tyrone and Fermanagh, &c., on the lower shelf, and on the upper, part of the collection of the Geological Survey, from the counties of Wicklow, Wexford, and Waterford.

In the fourth and fifth table cases are the collections made by the Geological Survey, from the Upper Silurian rocks of the Dingle promontory; and at the end of the wall case opposite, those from the Upper Silurian (Llandovery rocks) of Galway and Mayo.

In the eastern half of the gallery the sixth table case contains a series from the Carboniferous slate and Coomhola grits of Cork, &c.; and in the opposite wall case is the collection from the upper part of the Old Red sandstone of Kiltorcan, county Kilkenny. The remainder of the wall case is occupied by the duplicates of the collection of Carboniferous fossils, made

by Colonel Portlock in the north of Ireland. The other table cases, 7th, 8th, and 9th, are occupied by part of the Carboniferous collection made by the Survey in the south of Ireland.

The cross table at the end of the gallery contains Irish Coal Measure fossils. Returning to the west end of the gallery for a moment, and proceeding along the northern side of the southern row of table cases, we take up the British Palæozoic series, in the small table case, containing Cambrian fossils from Longmynd, and the *Lingula* flags and lowest Llandeilo fossils, from North Wales; and proceeding towards the east, the British duplicates will be found arranged opposite their respective Irish congeners, till we reach the Coal Measures at the eastern end of the gallery.

Then turning round to the passage between the table cases and the wall case, we have, along the south side of the eastern table cases, the British Permian fossils, the Irish Permian (partly collected by Colonel Portlock, partly presented by Professor King), and the Irish Lias, collected by Colonel Portlock; while in the wall case are arranged the British Oolitic series, from the Lias to the Purbecks inclusive.*

In the space at the eastern end of the wall case, however, near the head of the stairs, are some large slabs, one showing the footprints of a *Labyrinthodon*, from the Triassic rocks of North Cheshire, one a large slab of *Extracrinus* in iron pyrites from the Lias, and the others large annelid or molluscan tracks in the flags of the Coal Measures from Kilrush and Kilkee.

In the south-western division of the gallery we have, on the south side of the table cases, the Irish Cretaceous series, collected by Colonel Portlock, and the Irish Pleistocene and Recent specimens collected by the Survey.

In the corresponding wall case is the collection of British duplicate fossils of the Upper Secondary (Wealden and Cretaceous) rocks; those of the Eocene formations, including a good set of duplicates from the late Professor Edward Forbes's labours in the Isle of Wight, and a set from the Crag.

In the centre of the west end of the gallery is a specimen of the *Megaceros Hibernicus* presented to the museum by the Right Honourable the Earl of Mayo, and in the small wall case are several bones of the same animal, presented by Lady Elizabeth Butler.

Along the floor compartments of the wall cases are ranged those specimens of the respective formations which are too bulky to be placed on the shelves.

* The Great Oolite series contains a set given me, some years ago, by my friend Mr. Lycett, of Minchinhampton.—J. B. J.

THE COLLECTION OF ROCKS.

This is contained in the wall cases of the lower south-eastern gallery. It consists of, 1st, a large series of rocks, collected principally by the Geological Survey in the south of Ireland. 2nd, a series collected by the Ordnance Survey, under Colonel Portlock, in the north of Ireland. 3rd, a series of European rocks, purchased for the museum, from Mr. Krantz, of Bonn.

The collection made by the Geological Survey is arranged as follows:—

In the northern wall case, at the end next to the window, come a few of such common minerals as are the ordinary materials of which rocks are formed.

Then come the Igneous rocks—1st, the Lavas; 2nd, the Traps; and 3rd, the Granites. With the Lavas and Trap-
pean rocks are arranged some of their typical “ashes” or contemporaneous fragmentary accompaniments. The Lavas are, of course, brought from abroad. The Traps are principally Irish, with some British illustrative specimens. The Granites are in like manner chiefly Irish.

Next to the Granites are placed the specimens of Gneiss and Mica schist as being crystalline metamorphic rocks, with a schistose structure; and next to those the slates, as being altered by pressure.

At the end of the wall case are arranged specimens of coal, chalk, sandstone, and other rocks, which have been altered by the local contact of igneous rocks.

In the southern wall case are arranged the Aqueous rocks; at the east end, and at the end next the stove, are placed the picked specimens of Krantz's European series.

The Aqueous rocks consist of—1st, the rough mechanically formed rocks, the breccias and conglomerates, next the sandstones, and then the clays or argillaceous rocks. Some nodular concretionary structures are introduced here and there, showing the mode of occurrence of iron-stone for instance, in clay rocks.

Next to the clay rocks are placed the limestones, commencing with a fine series of Stalactites from the Mitchels-town caves, and embracing some characteristic specimens of the French tertiary limestones, the French and English oolitic limestones, and the Irish carboniferous limestones, of which some have also an oolitic structure.

The Magnesian limestones come next, after which are placed the Gypsums or sulphates of lime.

Lastly, some few characteristic specimens of lignite and coal.

For the principal varieties of coal and iron stone, however, the visitor must seek the western end of the north lower

gallery, where they are arranged, not so much geologically as with a view to their economic use.

Colonel Portlock's collection of rocks contains some valuable specimens of the typical rocks of the north of Ireland, but want of space to arrange it has compelled its being transferred to the upper shelves of the south side of the gallery.

Krantz's collection of European rocks consists chiefly of Igneous and Metamorphic rocks. It is placed partly on the shelves of the south-eastern wall case, near the fire-place, and partly in drawers under the table cases. It contains some interesting specimens both of the rocks of which examples are to be found in the British Islands, and of those which are not. Among the latter, attention may be more particularly called to the series of trachytes, to the lavas from Vesuvius and other places, and to the melaphyres and diorites, and the so-called wackes (or ashes or tuffs) accompanying these. The series of specimens of gneiss and those of syenite, especially of zircon syenite, and also of serpentine, gabbro, variolite, omphacite, eclogite, garnet rock, &c., are also interesting.

At the foot of the stairs may be seen a great block of rock-salt, from the Duncrae mines, near Carrickfergus, presented by the Most Hon. the Marquis of Downshire, flanked by two sections of Kilkenny coal, from Castlecomer, presented by the late J. B. Wandesforde, Esq.

On the north wall, on each side of the stove, are columns from the basaltic rocks of the county Antrim, on which are some specimens of basalt (Rowley rag) melted and cast by Messrs. Chance, near Birmingham, one being a sheet of rolled basaltic glass, one a piece of cornice moulding, and one lion, as architectural ornaments.

On the south side are some large blocks of anthracite, from Doonane, Queen's County, presented by Benjamin Edge, Esq., and one from Llanelly, Carmarthenshire, having a polished surface.

Under the stairs may be seen, on the north side, part of a granite vein, with its walls of altered Silurian slate, from Killiney hill, procured through the kind instrumentality of Matthias O'Kelly, Esq. There is also a specimen of polished hornblende rock, from County Monaghan, presented by Lord Rossmore; and one of polished red granite from Barnewmore, County Donegal.

Against the wall are arranged some large slabs of slate from Donegal and Killaloe, and a slate table, &c., from Valentia, presented by Mr. Blackburn, on the part of the Valentia Slate Company. Near the door of the physical preparation room, are a block and slab of white marble, from Dunlewey, Donegal.

J. B. J.

**EXPLANATION of the REFERENCES on the annexed LITHO-
GRAPH PLANS of the Museum Galleries and Offices.**

LOWER CROSS GALLERY.

WALL CASE A.

Building stones of England: duplicates of the collection made to determine the best materials for the Houses of Parliament in London.

Specimens of raw gypsum, septaria, and other materials used in making plaster and cements; specimens illustrative of their use.

Artificial stone made by Ransome's process.

WALL CASE B.

Building stones of Ireland: mechanically tested collection.

WALL CASE C.

Building stones of Ireland: topographical collection.

WALL CASE D.

Examples of raw materials and manufactured products selected from the London Exhibition of 1851, by the Royal Commissioners, as an illustration of British Industry.

TABLE CASES.

1. Specimens of decorative tiles, &c.
2. Aluminium, &c.: alum and its applications.
3. General Portlock's Irish topographical collection of minerals.
4. Series of specimens illustrative of the lead lodes of Allenheads, Northumberland, and the processes of dressing and smelting. Specimens illustrative of Pattinson's process of separating silver from lead.

MODELS.

I. *South end of Gallery—*

- Model of Ballycorus Lead Smelting Works.
- Model illustrative of the manufacture of sulphuric acid.
- Model illustrative of the manufacture of chloride of lime.
- Model of a pile-cutting engine.
- Model of Clarke's lapping machine.
- Model of a double shift man-machine, and of an improved gear for a mine whim.

II. *North end of the Gallery—*

- Series of models illustrating the various processes of extracting iron, and converting iron into steel.
- Model of a marine steam engine.

LOWER NORTH GALLERY.

WALL CASE A.

Containing specimens of English and Scotch coals ; series of rock—specimens illustrative of the Geological Structure of the Coal Measures ; iron ores, raw and calcined ; pig iron, high furnace and refining furnace cinders ; specimens illustrative of the manufacture of British bar iron ; series of Belgian iron ores, coals, &c., used at Seraing, in Belgium, and of the pig, wrought iron, and steel made therefrom ; series of the more important iron ores of Sweden and of New Zealand coal.

WALL CASE B.

Containing fossil wood, lignites, peat, peat charcoal, and peat ash, bog-butter ; products illustrative of the destructive distillation of wood, peat, and coal ; coals, fire-clays, iron-stones, and specimens of the rocks in the Coal Measures from the various Irish coal fields ; iron ores from various Irish non-carboniferous localities ; pig iron manufactured in Ireland, with coal, peat, and wood charcoal ; limestone used as flux and high furnace cinder.

TABLE CASES.

- 1, 2, 3. Manufacture of cast and wrought iron, steel, and its applications.
4. Specimens illustrative of the various methods of protecting iron from oxidation.

(Upper part of Case 4.)

Collection of specimens illustrative of the different ores of iron employed in the arts for the production of the metal, and for other purposes.

WALL CASES C & D.

Materials and products of the ceramic and vitreous manufactures.

TABLE CASES.

- 5, 6, 7. Historical and typical collection of earthenware and porcelain.
8. Glass manufacture and enamel.

(Near the Stairs.)

Terra cotta and tiles.

Chemical cabinet.

LOWER SOUTH GALLERY.

WALL CASE A.

Specimens illustrative of the ores of copper and lead, and of the processes of dressing and smelting them. Applications of metallic lead—pipe, and sheet lead, patent shot, &c. Chemical manufactures of lead.

WALL CASE B.

Containing ores of zinc, applications of metallic zinc, uses of oxide of zinc, &c.

Alloys of zinc and copper—brass, &c.

Specimens illustrating the manufacture of plain, fluted, ornamental brass tubes, stamped brass ware. Illustrations of brass button making, brass wire, &c.

A collection of Indian hammered, chased, and cast, brass, copper, bronze, and pewter work.

Ores of tin, rolled tin, tin plate, and specimens of Indian tin ware.

Ores of antimony; specimens of Britannia metal and solder; illustrations of Sturge's piece-mould casting of hollow ware, of ornamental articles of metallic ware by transfer of designs, and of the process of making hollow ware by spinning.

Illustrations of the manufacture of German silver and silver articles by the process of chasing and engraving, &c.

Illustrations of stereotype and wood engraving.

TABLE CASES.

1. Application of copper and its chemical combinations to different purposes; specimens of the more important Irish copper ores.

Copper ores with associated rocks, from the Cape of Good Hope.

Ores of copper having a scientific interest.

2. Reproductions of works of art by means of electrotyping.

Illustrations of the processes of electro silvering and gilding, &c.
(See also specimens near the window.)

Illustrations of French and English filigree.

- 3, 4, 5, 6, 7, 8, 9. Typical collection of minerals systematically arranged.

WALL CASE C.

Typical collection of igneous and metamorphic rocks.

WALL CASE D.

Typical collection of aqueous rocks, and Krantz's collection of European rocks, also General Portlock's collection of rocks from the N. of Ireland.

SMALL CABINETS NEAR THE STAIRS.

Physical apparatus.

UPPER CROSS GALLERY.

WALL CASE A.

Collection illustrative of vegetable products used for food, and other articles of domestic economy (soap, essential oils, &c.)

WALL CASE B.

General Portlock's collection of Irish birds.

CENTRAL GLASS CASE B. B.

General Portlock's collection of Irish birds.

WALL CASE C.

General Portlock's collection of Irish fishes.

GLASS CASES.

1. Collection of teas.
2. Animal products:—bones, horns, hoofs, &c.
3. Collection of dyeing and tanning materials.
4. Application of hairs and bristles.
- 5, 6. Illustrations of the manufacture of leather, and the dressing of furs, feathers, &c.
- 7, 8, 9. General Portlock's collection of Irish mollusca and shells.
10. Collection illustrative of the uses of animal fats, swimming bladders of fish, dried fish, &c.
11. Collection of models of fishing boats.

WINDOW CASES.

- 12, 13, 14, 15. Collection of sea weeds: illustrations of the products obtained therefrom, (iodine, &c.) Collection of corals, sponges, shells, and specimens illustrative of their uses.

UPPER NORTH GALLERY.

WALL CASE A.

Specimens of the various kinds of raw cotton.

Illustrations of the cotton manufacture.

- " of calico printing.
- " of cotton thread (in detached case A. A.)
- " of the linen manufacture.

WALL CASE B.

Collection of native and foreign woods.

- " of Indian lacquered work.
- " of flax, and of the various modes of preparing it.
- " of hemp, jute, and other fibres.

WALL CASE C.

Collection of vegetable fibres.

- " of seeds used for food, ornamentation, &c.

Illustrations of the various kinds of India-rubber coming into commerce, and of the preparation and uses of India-rubber.

Illustrations of the manufacture and uses of gutta percha.

WALL CASE D.

Illustrations of the silk, woollen, alpaca, mohair, and mixed silk and woollen manufactures.

Illustrations of the manufacture of horn buttons, scales, combs, &c.

TABLE CASES.

1. Specimens of straw, split willow, &c., plait; various articles made from it.
Samples of carpets, &c., made from Manilla hemp, cocoa nut, Esparto fibre, &c.
2. Specimens of China grass: thread and tissue made from it, and from various other fibres.
Specimens of shoe thread made from Irish flax.
3. Illustrations of the manufacture of English papier-maché.
Illustrations of the paper manufacture.
" of the manufacture of room paper.
(German stamped ornamental paper, in a frame on the wall.)
- 4, 5, 6. Specimens of lace, crochet, &c.: Irish fibres and fabrics made therefrom.

MODELS.

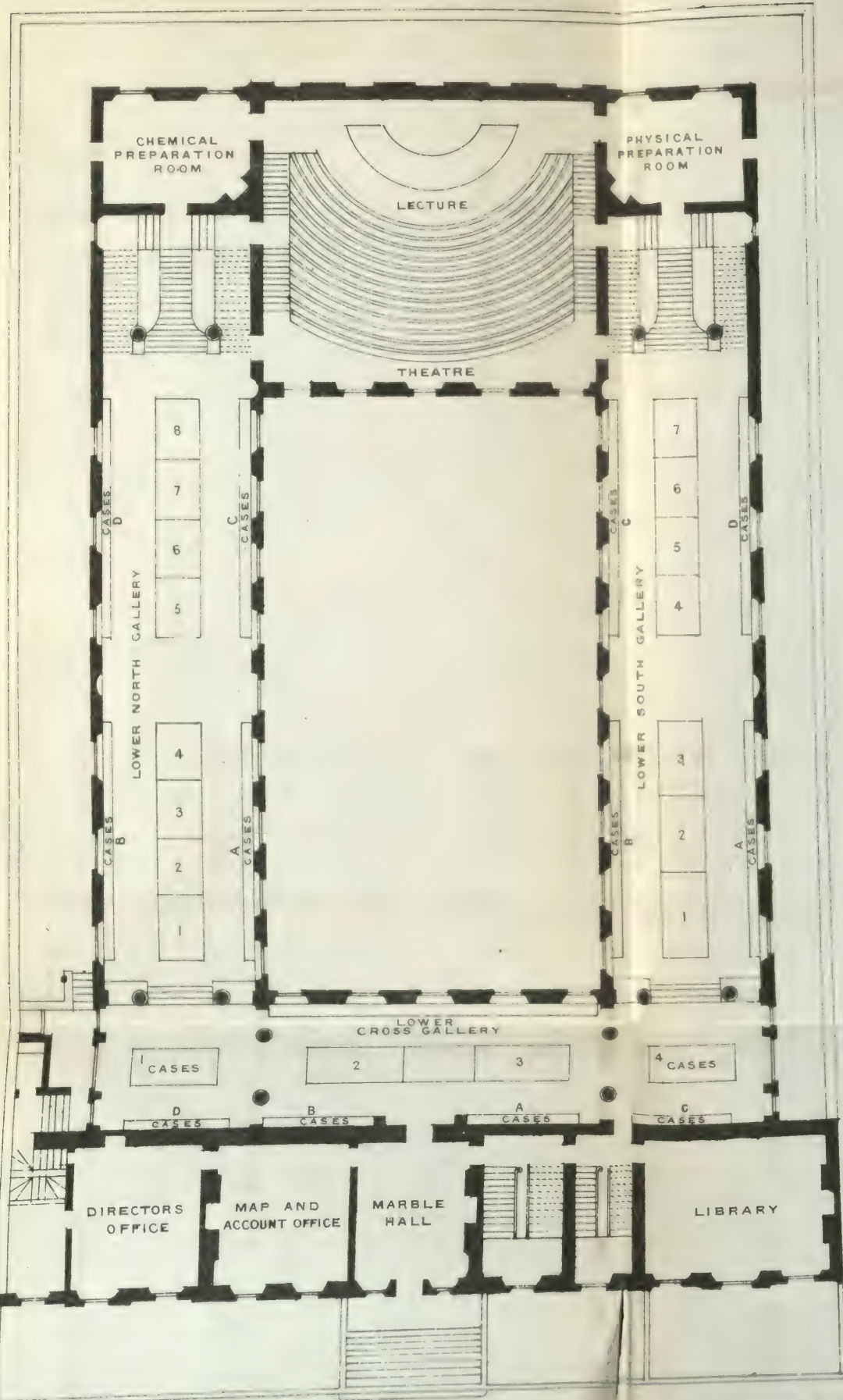
Silk winding machine, velvet, Jacquard, girth, carpet, and other looms.

UPPER SOUTH GALLERY.

Palæontological collections.

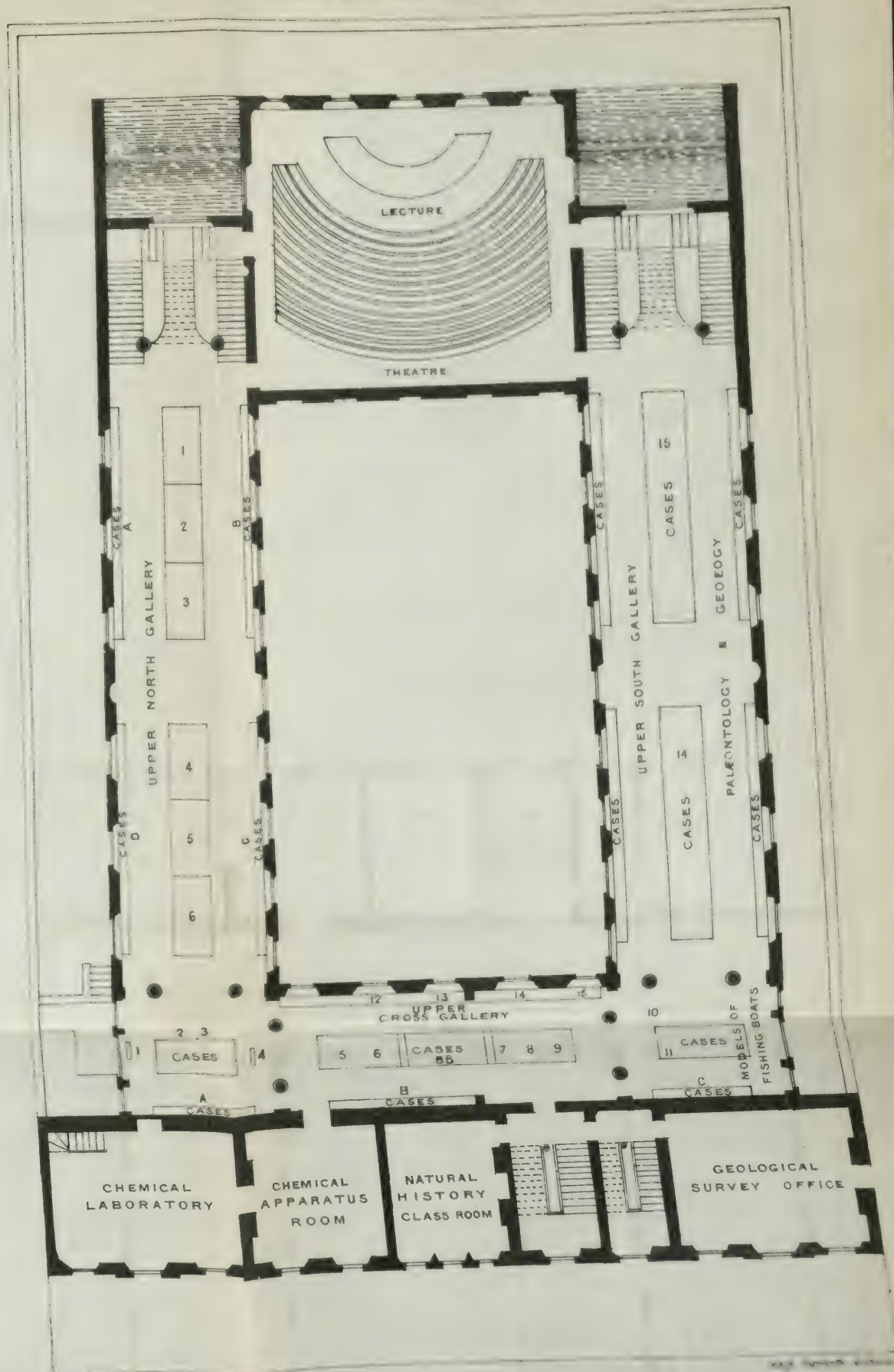
A. G.

MUSEUM OF IRISH INDUSTRY



LOWER GALLERIES & OFFICES

STEPHEN'S GREEN, DUBLIN.



UPPER GALLERIES & LABORATORIES.

SCALE OF 10 5 0 10 20 30 FEET



PROGRAMME OF EDUCATIONAL ARRANGEMENTS.

SYSTEMATIC.

THE systematic courses of scientific lectures delivered in the theatre of the Museum of Irish Industry commencing with the Session of 1854-1855, may be considered as the first fully organized arrangement carried out in Dublin to provide those who are occupied in the day time with the means of employing their leisure hours in the evening in learning thoroughly the more practically useful branches of science. The success of the experiment, notwithstanding that the advantages offered could not at the outset have become generally known, has been such as to fully call for a continuation of it during the succeeding session.

But while the education of that numerous and important portion of the public will be provided for, it was proposed to extend still further the utility of those educational arrangements for the future, by establishing corresponding courses of lectures on the several departments of applied science, to be delivered during the day, and the arrangements adopted for that object have been found so successful, that they will be continued in the approaching Session, with only such slight modifications in detail, as experience has proved to be desirable.

DAY AND EVENING CLASSES.

In the session of 1861-1862, accordingly, there will be two distinct and independent series of courses of lectures—the one to be delivered in the day time, the other in the evening. The number of lectures in each course will be found in the detailed calendar annexed.

PLACE OF DELIVERY.

In addition to the systematic courses of lectures given during the preceding years, and which were wholly delivered in the theatre of the Museum of Irish Industry, each professor gave an additional course of twelve lectures of a popular character in the theatre of the Royal Dublin Society, under the direction of the Committee of Lectures, conjointly appointed by the Government and the Royal Dublin Society. With the view of rendering those lectures of greater utility, it was proposed to bring them into connexion with the systematic courses. The joint Committee, under whose direction the arrangements for those lectures were carried out, having at once sanctioned this connexion, the first twelve lectures of each systematic course of day

lectures have been approved of by them accordingly, and will be delivered in the theatre of the Royal Dublin Society, in lieu of the popular lectures hitherto delivered there. The remaining twenty lectures of each day course will be delivered in the theatre of the Museum of Irish Industry.

Each professor has hitherto also given a course of evening popular lectures in the theatre of the Museum of Irish Industry. In future it is proposed to make these lectures part of the evening systematic courses; but in order to avoid the inconvenience which would arise of having two lectures on the same day in the same theatre, two of the evening courses will be wholly delivered in the theatre of the Royal Dublin Society. Accordingly, during the delivery of day lectures in the theatre of the Royal Dublin Society, any evening lectures which may be given during the same period will be delivered in the theatre of the Museum of Irish Industry; and when the latter theatre will be occupied during the day, the evening lectures will be given in the theatre of the Royal Dublin Society.

In this association of all the lectures of a popular character with the systematic ones, the privileges which the public has hitherto enjoyed will not be interfered with, while it is hoped that the utility of the lectures will thereby be very greatly increased.

TIME AND MANNER OF DELIVERY.

As a large number of persons will attend these courses whose time and attention will necessarily be more or less occupied with business, it has been thought judicious that lectures on two different subjects should not alternate as heretofore, but that each course, or division of a course, should end before a different course be commenced. This arrangement, which will prevent the continued alternation of different subjects, and consequent danger of confusion of ideas, will, it is hoped, be of equal advantage to those students who can devote their whole time to study.

The session will commence on Thursday, the 3rd of October, 1861, and end on Friday, 13th June, 1862.

On the 3rd of October, the Director, Sir R. Kane, will deliver an opening address at eight o'clock, p.m., in the theatre of the Museum of Irish Industry.

DAY CLASSES—*Before Christmas.*

Zoology.—On Monday, the 7th of October, the Professor of Zoology will commence a course on Geographical and Palæontological Zoology in the theatre of the Royal Dublin Society, at four o'clock, p.m., to be continued every day, Sa-

turday excepted, until completed. This constitutes the first part of his systematic course, consisting of twelve lectures.

Physics.—On Thursday, October 24th, the Professor of Physics will commence his course in the theatre of the Royal Dublin Society, at four o'clock, P.M., to be continued every day, Saturday excepted, until he shall have completed the first part of his course, consisting of twelve lectures.

Chemistry.—On Monday, November 11th, the Professor of Chemistry will commence a course of twelve lectures, in the theatre of the Royal Dublin Society, at four o'clock, P.M., to be continued every day, except Saturday, until completed.

Geology.—On Friday, December 6th, the Professor of Geology will commence a course of twelve lectures (being the first of his general course), in the theatre of the Royal Dublin Society, at four o'clock, P.M., to be continued every day, except Saturday, until completed.

After Christmas.

Geology.—On Monday, January 6th, the Professor of Geology will resume his course at four o'clock, P.M., in the theatre of the Museum of Irish Industry, and will continue, at the same place and hour, on every day in the week, except Saturday, until the course be completed.

Chemistry.—On Wednesday, February 19th, 1862, the Professor of Chemistry will resume his course at four o'clock, P.M., in the theatre of the Museum of Irish Industry, and will continue, at the same place and hour, on every day in the week, except Saturday, until the course be completed.

Physics.—On Monday, April 7th, the Professor of Physics will resume his course at four o'clock, P.M., in the theatre of the Museum of Irish Industry, and will continue, at the same place and hour, on every day in the week, except Saturday, until the course be completed.

Botany.—The Professor of Botany will commence a course of lectures on Botany, on Tuesday, May 13th, at 4 o'clock, P.M., in the theatre of the Royal Dublin Society, to be continued at the same place and hour on every day of the week, except Saturday, until the course is completed.

EVENING CLASSES—Before Christmas.

Zoology.—The Professor of Zoology will commence a course of lectures on Zoological Classification and Physiology, on Thursday, October 24th, at eight o'clock, P.M., in the theatre of the Museum of Irish Industry, and will continue at the same place and hour, on every day of the week, except Saturday. This completes the systematic course.

Geology.—The Professor of Geology will commence a course of twelve lectures on Physical Geography, on Wednesday, November 20th, at eight o'clock, p.m., in the theatre of the Museum of Irish Industry, and will continue, at the same place and hour, on every day of the week, except Saturday, until the course be completed.

Chemistry.—The Professor of Chemistry will commence a course of lectures on Chemistry, on Friday, December 6th, at eight o'clock, p.m., in the theatre of the Museum of Irish Industry, to be continued, at the same place and hour, on every day of the week, except Saturday, until the course be completed.

After Christmas.

Physics.—The Professor of Physics will commence the first part of his course of evening lectures on Monday, January 6th, 1862, at eight o'clock, p.m., in the theatre of the Royal Dublin Society, and will continue, at the same place and hour, on every day of the week except Saturday, until the course be completed.

Botany.—The Professor of Botany will commence his course of lectures, at eight o'clock, p.m., on Monday, May 12th, in the theatre of the Museum of Irish Industry, and will continue, at the same place and hour, on every day of the week, except Saturday, until completed.

A table of the days, hours, and places of delivery of the lectures, arranged as an almanac for each month, is appended, and will serve as a useful guide to students and the public generally.

REGISTRATION AND FEES.

No person will be considered eligible to compete for certificates or prizes, unless he shall have registered himself as a student and paid the requisite fees.

The office for registration is at the Museum of Irish Industry, where Mr. Penny will receive the names of all who are desirous of entering as students, and supply them with admission tickets.

Students may register for one or more of the courses, and compete for the special certificates and prizes allotted to each course, but can only become eligible for a General Certificate by registration for and attendance upon a course in each of the four subjects, either in the day or evening classes.

As the first twelve lectures of the day classes will represent the popular lectures hitherto delivered at the Royal Dublin Society, under the direction of the Committee of Lectures, they will be free to the public; for the remaining twenty lectures a fee of 3s. 6d. will be charged for the lec-

tures on chemistry, on natural philosophy, or geology, and 2s. for the lectures on zoology or on botany.

The first twelve lectures of the evening classes, representing the popular evening lectures hitherto delivered in the Museum of Irish Industry, under the direction of the Committee of Lectures, will likewise be free to the public; for the remaining eight a fee of 6d. will be charged, wherever they may be delivered.

EXAMINATIONS.

At the close of the courses of systematic lectures of each professor, a Special examination of the registered students will be held by the lecturer, and the names of those who pass it will be arranged and published in order of merit.

At the close of the session a General Examination will be held in all of the subjects lectured on in the school, open to all those who shall have attended one course at least in each of the five subjects, in either the day or evening classes, and passed *one* at least of the Special examinations, either of that or of the previous session.

Students who have passed a Special examination, but not gained a prize, will be admitted to one more Special examination in the same subject, after which they will not be deemed eligible for a prize in it.

Students who have once passed a General Examination will not be admitted to any further examination of any kind.

PRACTICAL INSTRUCTION.

Chemistry.—In the chemical laboratory practical instruction will be given, during the session, in qualitative and quantitative analysis, and in the method of performing chemical researches. (The reader is referred to the complete Programme of Educational Arrangements, page 100, for a more detailed account.)

Botany.—The Professor of Botany proposes to hold a series of excursions for herborizations on days to be subsequently decided upon, of which due notice will be given to the classes by the professor.

Zoology.—The Professor of Zoology will hold excursions for the purpose of field study, of which due notice will be given to the class.

LECTURES.

On Monday, November 25th, the Professor of Zoology will commence a course of twenty lectures on Structure and Physiology (being the third of the general zoological courses), at the Museum of Irish Industry at 3 P.M., in the

Zoological Class-room. The lectures will be continued till completed on every week-day except Saturday.

On Monday, January 6th, 1862, the Professor of Zoology will commence the concluding course in General Zoology, on Histology, and the Microscope, at 7 P.M., in the Zoological Class-room, in the Museum of Irish Industry, and will continue the subject at the same hour and place on Mondays, Tuesdays, Wednesdays, and Thursdays until completed.

Geology.—The Professor of Geology will also make some excursions, for the purpose of giving such students as can accompany him practical lessons upon the method of observation in the field. The Professor will arrange with his classes as to the time of his holding these excursions.

CERTIFICATES AND PRIZES.

Two kinds of certificates will be granted—

PASS CERTIFICATES will be given to such as pass each Special examination, whether Systematic or Practical.

GENERAL CERTIFICATES, signed by all the Professors, and countersigned by the Director, will be given to those who shall pass the General Examination.

The value of certificates testifying to a knowledge of the more practically useful branches of science will become duly more and more recognised; and already a very large number of the leading manufacturers of the United Kingdom have agreed to accept similar certificates as one of the highest testimonials which can be presented by persons seeking employment in their establishments. Every student should, therefore, strive to win such a certificate.

PRIZES will be awarded to the first three names in the list of those who pass each examination, provided sufficient proficiency be shown.

These prizes will consist either of money, or of books stamped with the mark of the institution, or partly one and partly the other, at the option of the student.

The value of the prizes will be—

SYSTEMATIC COURSES.

For the Special examinations,

First prize, £3; second prize, £2; third prize, £1.

For the General Examination,

First prize, £7; second prize, £5; third prize, £3.

PRACTICAL COURSES.

The sum of £6 and two free admissions will be awarded in prizes to the evening classes of Practical Chemistry, as will be arranged after the classes are formed.

Prizes may be awarded in the class of Practical Zoology, as will be arranged on the formation of the class.

No person having gained a Special prize will be deemed eligible again for a prize in the same subject.

The session will be closed by an address from the Director, Sir Robert Kane, when the public award of the certificates and prizes will take place.

EVENING ADMISSION TO THE GALLERIES AND LIBRARY OF THE MUSEUM OF IRISH INDUSTRY.

Nothing tends so materially to familiarize the mind with scientific names, and to impress upon the memory the information acquired from books and lectures, as the examination of the objects themselves, the study of whose properties or forms constitutes the basis of the experimental and observation sciences. This is especially true of natural history and geology, and, perhaps in an equal degree, of chemistry in its applications to industry. The collections illustrative of chemical compounds and chemical manufactures, and of geology, now in the galleries of the Museum of Irish Industry, are sufficiently extensive to be useful in this way. With a view, accordingly, of making them contribute as far as possible to public education generally, and especially to the development of the system of instruction established in the School of Arts and Manufactures, the galleries will be lighted with gas, and opened to the public on all the evenings of lecture during the session, and on such other evenings as shall be arranged, of which due public notice will be given.

With a view of facilitating the studies of those students who are occupied during the day, and cannot therefore visit any public library, access will be allowed to the library of the Museum of Irish Industry, which is provided with a number of suitable books in each department of science, selected by the respective professors. This library will be opened during the session at times and hours to be hereafter determined. The privilege of reading in this library must necessarily be exclusively confined to those students who desire to qualify for certificates by attendance upon all the courses, in one or other class, given during the session.

RECOMMENDATIONS TO STUDENTS ABOUT THEIR PRELIMINARY STUDIES.

The best preparations for the study of any branch of science is the study of mathematics, not merely because it is itself the first of the fundamental sciences, and in some cases the most powerful and indispensable instrument of research,

but even as a mere mental exercise. A familiarity with mathematical reasoning usually gives more definiteness and exactness of ideas, and leads the student to disregard the usual vague and loose statements which the untrained mind is apt to accept as science, while it teaches him to set most value in the experimental sciences upon numerical relations, not only as the most important in a theoretical point of view, but also in a practical one.

A knowledge of the four principal operations of arithmetic (addition, subtraction, multiplication, and division), vulgar and decimal fractions, the extraction of square and cube roots, ratio and proportion, and the elements of geometry, will enable a person to acquire a very good knowledge of experimental physics and chemistry. Without this amount of knowledge, at least, many important points in both branches of science must be unintelligible, or at best must be very imperfectly understood.

And as it is impossible to have an accurate knowledge of animal and vegetable physiology, which are the basis of the other divisions of natural history, or of geology, without some previous knowledge of experimental physics and chemistry, this amount of elementary mathematics is equally necessary to the student who desires to pursue in an especial manner those branches of science.

There is one very simple truth which it is very desirable should be impressed upon the minds of students—namely, that in order to apply science to industry, it must be first learned; and that, consequently, the impression which commonly prevails, and which some, who ought not to do so, have helped to foster, that there is a kind of inferior science adapted for practical persons, is perfectly erroneous. Indeed, no one requires to know science so thoroughly as he who intends to apply it in his business. The kind of science which is capable of being applied to industry with advantage must therefore be, in reality, of a far higher character than what is required as an element of general education.

Persons who intend to register themselves as students of the School, with a view of applying the knowledge of science which they may acquire in some of the various branches of industry, such as mining, the construction of machines, textile and chemical manufactures, agriculture, &c., will do well to remember, that although the amount of mathematics mentioned above will enable them to acquire a vast amount of information in the subjects taught during the session, it will be far from sufficient to enable them to apply it with profit in industry. Such questions as the strength of materials; the flow of water, steam, or gas, through pipes; the

construction of water-wheels and turbines; or the theory of machines in general, and similar questions which perpetually present themselves to the manufacturer, require for their solution a considerable amount of mathematical knowledge.

While it is to be hoped that no one will be discouraged from joining the classes of the ensuing session because they may not have previously studied the elementary mathematics, all who desire to acquire that accurate knowledge which alone is practically useful, should endeavour, either by self-instruction, or through the many facilities which exist for the purpose, to learn, at least, the most indispensable branches of elementary mathematics.

With a view of pointing out the extent of mathematics which it would be desirable that students who intend to become mining engineers, ship-builders, machinists, or managers of factories generally, should possess, before commencing the study of the experimental sciences, and of guiding those who desire, in the mean time, or in future years, to reach this standard of preparation by self-instruction or otherwise, the following syllabus of a course of elementary mathematics is added. Such a course would take the student as far as the calculus, and would enable him to understand all lectures upon mechanics, statics, and dynamics, and make use of the generality of text books upon those subjects. Before entering upon the course of study the student would derive great advantage from the reading of some work on logic of the character of the "System of Logic," by J. S. Mill, or Thompson's "Laws of Thought."

SYLLABUS OF A COURSE OF ELEMENTARY MATHEMATICS, PREPARATORY TO THE STUDY OF THE PHYSICAL AND NATURAL SCIENCES, AND OF THEIR APPLICATION TO INDUSTRY.

Arithmetic.—Numeration and notation. *Integral Numbers*:—The four principal operations of arithmetic with whole numbers (addition, subtraction, multiplication, and division). Determination of the greatest common divisor of two or more numbers, and the simplest common multiple. *Fractions*:—1° *Vulgar Fractions*—Formation of vulgar fractions; the four principal operations with them. 2° *Decimal Fractions*—Distinction between vulgar and decimal fractions; the four principal operations with decimal fractions; conversion of vulgar fractions into decimal fractions, and the reverse.

Extraction of roots.

Ratio and proportion.

Geometry.—1° *Plane Geometry*—Properties of lines and angles. Properties of triangles and quadrilateral figures. Ratios and proportions. Geometry of the circle, and the measure of angles. Regular polygons, and the measure of the circle.

2° *Solid Geometry.*—Intersection of planes—solid angles. Solids bounded by planes:—The parallelopiped; polyhedrons. The three round bodies:—The cylinder, cone, and sphere. Properties of the sphere and spherical triangles.

Or the whole of Euclid's Elements of Geometry.

Elements of Geometrical Analysis.

Algebra.—The four rules with monomes and polynomes. Simple powers and roots. The greatest common measure, and the least common multiple. Fractions.

Equations of the first degree, including one unknown quantity. Equations of the first degree, including two or more unknown quantities.

Arithmetical progression. Geometrical progression. Permutations and combinations. Series and indeterminate coefficients. Binomial theorem.

Equations of the second degree. Exponential equations. Exponential and logarithmic series. Use of logarithms.

Classification of algebraical expressions and consequences. Relation between number and magnitude.

Trigonometry.—Definitions. Relations of trigonometrical lines. Relation between sines, cosines, &c., of sums, and differences of angles. Solution of plane triangles.

Elements of Analytical Geometry.—Application of algebra to the theory of Curves:—Straight lines; transformation of co-ordinates; lines of the second order, or the conic sections. Application of algebra to the theory of Surfaces:—The straight line in space. The plane. The sphere, cylinder, and cone. Surfaces of revolution. Surfaces of the second order.

Descriptive Geometry.—Projection of lines, of planes, and of curved surfaces. Intersections of lines, planes, and surfaces. Applications to cylindrical, conical, and spherical surfaces. Skew surfaces. Theory of ordinary perspective and of isometrical perspective. Theory of shadows.

R. K.